

Midwest Engineer



Vol. 10

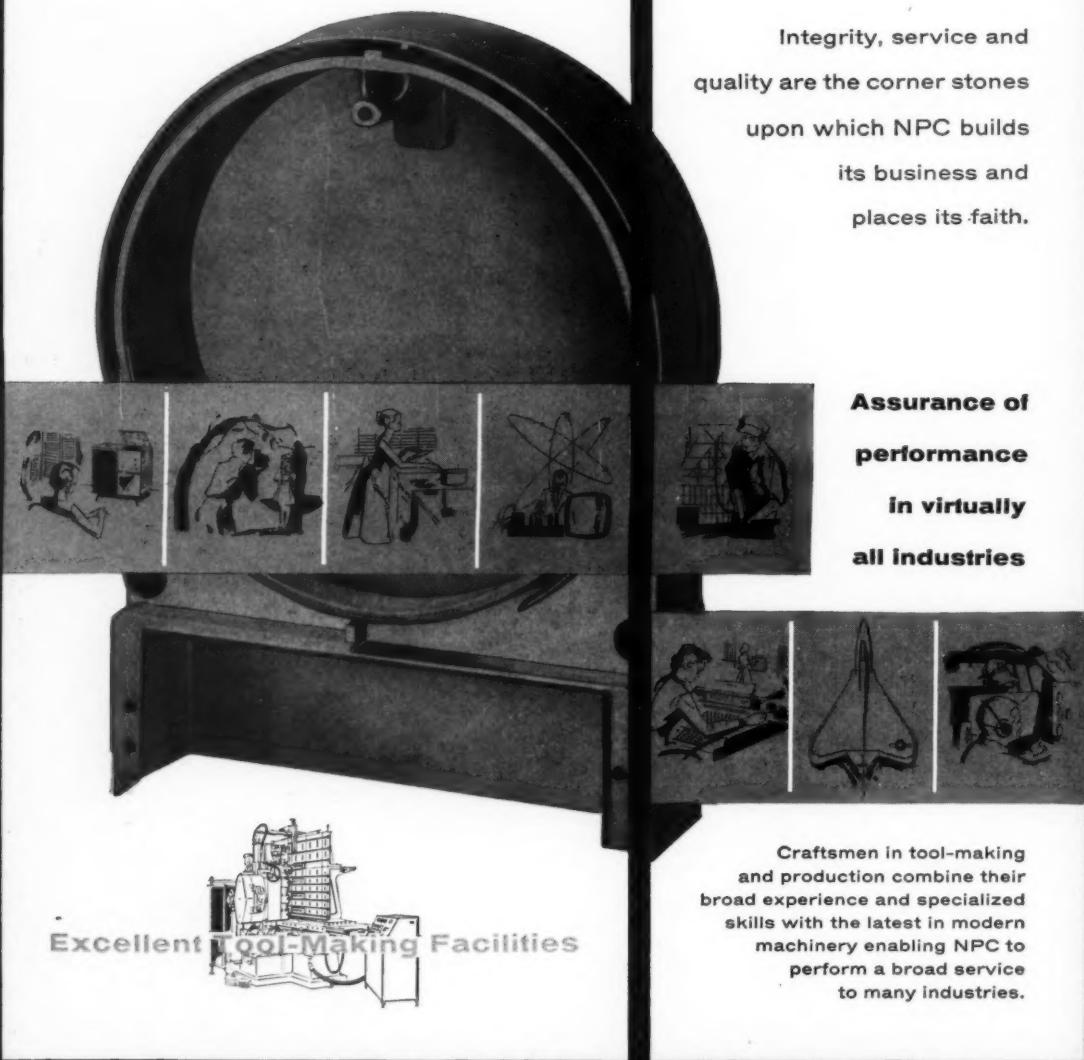
BETTERMENT OF STATE ENGINEERING PROGRAMS
THROUGH RESEARCH - PART THREE

NOVEMBER

No. 6

NPC Die Castings

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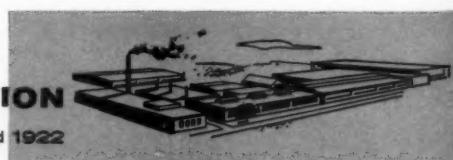


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COVER STORY

The new \$10,000,000 United Engineering Center, to be erected on United Nations Plaza between 47th and 48th Streets, New York City, will serve as headquarters of sixteen National Engineering Societies with a total membership of about one-quarter of a million engineers. See page 30 for more information.



**Field Trip
to the new
Automatic Electric Company
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Note the New Date

Is communications your interest? The workings of the new Automatic Electric Company Plant in Northlake, Illinois, a pioneer in automatic telephone communications, will be of special interest to you. Are ultra-modern building and construction features your interest? The 35 acres of floor space under one roof, incorporating the newest in design and a truly unique method of construction will be of special interest to you. Is electrical power your interest? This self-contained city, with enough electrical power to supply a city of 10,000 will be of special interest to you. In short, if you want to

see tomorrow's industry in operation today—Automatic Electric is it!

The WSE sponsored Field Trip will begin at 7:30 p.m. at the Northlake plant. If a sufficient number of people request it, bus transportation will be provided at nominal cost and will leave Western Society Headquarters, 84 East Randolph, at 6:15 p.m.

If you plan to drive to Automatic Electric, take Lake street or North avenue to Wolf road, then turn right on Wolf road about one-quarter mile to the plant.

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Betterment of State Highway Programs

By J. H. Euston, MWSE

Research is a familiar and rewarding practice of State Highway Departments. The Highway Research Board has been active since 1920. The universities, associations and institutes that serve in the highway field feed research results into operations continuously.

Some areas of operations have been covered more thoroughly than others. This paper outlines the general state of research and points out opportunities for very promising research in administrative procedure, organization and personnel administration.

The Situation

The demands now made on State Highway Departments are, of course, unprecedented. The reasons are: A larger population with more automobiles, more money to spend, and more urge to travel farther and faster than ever before, and the pressure of the 51 billion dollars Federal Highway Program.

The state highway departments face these demands with depleted technical staffs and inadequate salary scales. These are the tough situations. Counterbalancing these difficulties in part are two powerful new methods of labor-saving—photogrammetry and electronic data processing. And in the background are research facilities and results that can help state highway departments build better highways with more satisfaction to their staffs and with less wear and tear on their officials than now seems possible.

Close the Gap Between Research and Practice

By definition, research must move ahead and keep ahead of operating practice. The lag between publication of research findings and their application to current practice is necessary. Time is needed for dissemination, study, and testing of research results. However, this

lag can be shortened and improvements can be had earlier if ways can be found to evaluate research results and to make prompt decisions on whether or not to apply them.

How is this to be done? (1) Know what research is going on and appraise the results as they are published. (2) Be critically aware of shortcomings in present standards, methods, and results. Whenever these new findings and old problems match, there is an opportunity for remedial action.

The cataloging of research results can be—usually is now—a responsibility of the Planning and Research Division of the State Highway Department.

The rating of present standards, methods, and results, and the identification of management problems is a management responsibility.

Development of rating procedures, the making of surveys and studies to identify and solve management problems are research projects. This paper proposes to outline some of the opportunities that may be grasped to improve the present difficult situation by specific research in the various fields of highway engineering, operating, and administration.

Research

Engineering research and physical research have accomplished wonders for our highways. The problems are being attacked from all sides. Yet, it must be that we are not building as good highways as research indicates that we can build. Publication lags behind research, design lags behind publication, and construction behind design. There are failures in communication, inadequate education and training, and considerable inertia in the long process from research to practice.

This is the situation that the departmental Planning and Research Divisions can improve. Witness the effective use they are making of the "Sufficiency Rating Study," which they developed among

themselves. This is a wonderful example of an engineering attack on a continuing problem:

- (1) Inspect
- (2) Refer to standards
- (3) Evaluate
- (4) Specify corrective action
- (5) Determine requirements to take corrective action
- (6) Incorporate requirements in planning and scheduling
- (7) Follow up execution of plans
- (8) Evaluate results

The Highway Research Board of the National Research Council is organized to lead and coordinate the research which is the subject of this section. Its departments are:

Economics, Finance, and Administration
Highway Design
Materials and Construction
Maintenance
Traffic and Operations
Soils
Special

These departments are representative of the individuals and the organizations which are concerned with highway activities: the state highway departments, federal agencies, industrial institutes and associations. In addition, the Highway Research Board, with the cooperation of the state highway departments and the Bureau of Public Roads, conducts the Research Correlation Service. This service acquires and passes on information on the progress and results of research to interested, cooperating agencies.

It is apparent that Research is firmly established as a principle and practice in highway technology. It is ably led and coordinated. The need is to capitalize on the results of research more fully by cataloging the new developments and matching them as possible remedies against deficiencies in operations discovered by inspection, ratings, and special surveys.

Mr. Euston, MWSE, vice-president and secretary, Business Research Corporation, won a prize of \$50 for this paper in the Western Society of Engineers 1957 Prize Paper Competition.



A road earning money? Absolutely! Every road earns money in the form of gas taxes and license fees paid by drivers using it. The more vehicle miles of traffic a road handles the more money it earns.

The road pictured is U.S. 40, northeast of Baltimore. It carries a daily average of 45,000 vehicles, many of them commercial. Here's how the earnings of this concrete road are computed:

Vehicles traveling this road per day	45,000
Times average vehicle tax per mile in Md.	\$0.00714
Equals earnings per day per mile	\$321.30
Times number of days a year	365
Equals annual earnings per mile	\$111,275
Minus the annual cost to build and maintain such a road during its lifetime	\$20,000
Equals annual profit earned per mile	\$97,275

Similar analyses elsewhere show that concrete roads earn the most "profit." That's because they attract the most traffic and have the longest life.

For example, concrete carries the load on 92% of the pavement of the 25 most heavily traveled rural

road sections in America. And official studies reveal that concrete has at least twice the life expectancy of the next most commonly built pavement.

Concrete roads usually earn *more* than they cost to build and maintain. The "profit" pays for additional miles of new highways. In contrast, other commonly built pavements have such a relatively short life and require such frequent and expensive maintenance that they earn *less* than they cost to build and maintain. Thus they drain an increasing amount from available funds for maintenance, leaving a decreasing amount for building critically needed new mileage.

Highway users expect engineers and public officials to invest their money in roads paying the best dividends. That means paving all main roads with concrete, the self-supporting, profit-making pavement.

For more information about designing and constructing low-annual-cost, high-earning-capacity concrete highways, write today for free literature, which is distributed only in the United States and Canada.

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Application of New Techniques and Equipment

As mentioned earlier, the highway situation is made less difficult because of the availability of new ways of doing what have been routine, laborious engineering and technical jobs. Only a few of these innovations will be mentioned because they are well known and because highway departments are profiting from them to an increasing degree.

The questions to be answered are not those about the worth of the new methods for this has been proved. The questions are economic and procedural—exactly when and how are they to be applied.

Photogrammetry

Aerial mapping techniques have been expanded from the supplying of simple "bird's-eye-view" photographs to a comprehensive mapping service with degrees of precision comparable with good ground survey techniques. The speed with which mapping can be done from the air is remarkable, saving the tremendous amounts of time once required by ground survey parties. Photogrammetric methods now can supply location surveys; detailed large-scale study photos; photo-mosaics for promotion and public information; typographic maps, as well as profile and cross section surveys. Cross sections can be supplied directly from the photogrammetric instruments, either graphically or in tabulations, that can be fed into electronic instruments for calculating earth work data.

Photogrammetric techniques, therefore, offer relief from chores that have been taking too much engineering time. Proper application of these techniques will not only get work done rapidly and well, it will change present engineering and technical positions.

Electronic Calculators

Electronic calculators are being used now for highway and structural design calculations and also for earth work calculations. Pioneer applications have worked most of the bugs out of these calculating programs. Cut and fill computations, for example, have been run from punched cards at rates of approximately six miles of road per hour.

Electronic calculators have been connected to photogrammetric plotters so that earth work quantities can be computed directly from aerial photographs.

Such calculations are accurate enough for bidding purposes and even for pay purposes.

Programs have been worked out and proved for other tasks, such as: balancing traverses and calculating errors of closure in surveys; computing sufficiency ratings of highways; comparing earth movement and quantities for various route locations or highway designs; and even for solution of complex traffic problems.

Here again, new equipment is being used to change engineering positions and

engineering work loads so as to release engineers for professional work.

Electronic Data Processing

Some highway departments are using general-purpose electronic systems to process accounting and operating transactions as well as for engineering computations. This offers relief, not only for accounting clerks but engineers also, and it has advantages because of the tremendous capacity for detail that these general-purpose systems have. The problems of feasibility are not great, but the

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A maximum of five prizes may be awarded, depending upon the number and quality of the papers submitted. Minimum value of the First Prize will be \$150.00.

Papers must be submitted by April 1, 1958.

Winners will be announced and the prizes presented at the annual meeting of the Society in June.

Rules and requirements of the competition may be obtained by returning the coupon below or by telephone request to WSE Headquarters (RAndolph 6-1736)

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economic questions can be answered only after careful study and the system work and mathematical programming required for an installation are costly and time-consuming. Yet electronic data handling systems offer the only comprehensive and long-range solution to the problems of detailed accounting routine, detailed engineering calculations, and comprehensive planning and forecasting for growth.

Growth Planning

State highway departments work with programs that they design to satisfy the public and governmental ever-changing requirements for highways. Through programs the highway departments plan and execute series of projects. The program is a means of coping with a continuing, changing situation; the project is a method of handling a particular, limited problem in a situation.

Programs deal with highway engineering and operating functions. Understanding and implementing a program in time implies that everything else is predetermined in time—that is, all requirements are predetermined for:

1. The organization, its nature and scope.
2. The personnel staff, its quantity and number.
3. The funds, their source and application.
4. The engineering and operating standards.
5. The materials, their source, quality, and availability.
6. The plant and equipment for construction and maintenance.
7. The methods: engineering, operating, and administrative.

If programming, then, is the general method of administering highway activities, it would seem to be important that all programs pull together toward one objective; that they integrate the various functional programs just mentioned. This integration has to be based on some concept and directed toward a goal. The only concept that is broad enough for this purpose probably is "Growth." Growth is mandatory, it is dynamic—it is appropriate to the American Way. The goal toward which growth planning is to be directed must be an advancing goal, one that is always moving ahead of present practice—paced by economic and social trends and research findings, and constructive dreaming.

Why Plan Ahead?

If the highway situation has problems of an emergency nature—and it does—why bother about planning for growth now? The big reason is that it will save executive time and permit managers to manage affairs rather than cope with crises.

Planning for growth will do these things for highway program managers:

1. It will reduce uncertainties
2. It will foster concentration on essentials
3. It will reduce fruitless work

Growth planning is based on the concept that the entire complex of activities is a "Process." A process has inputs and outputs. It has means of controlling them and maintaining a balanced rate of flow through feed back. Each step of a process is predetermined in its design. Once the output is determined in time all the inputs are also determined by kind, where they are to enter the process, when they are to enter, and what the rate of input is to be.

So a highway system and program can be planned for growth—as a process. Programming of the proper and timely "inputs" of money, personnel and materials according to the appropriate engineering and business standards and methods will accomplish—are certain to accomplish—the highway system as the necessary and desired "output."

This is not an academic concept. It's a very practical idea for reducing difficulties and crises in management and frustrations in staff and criticisms from the public. One reason why it is so practical now is that means are available through electronic data processing systems to do this planning quickly, completely, and as often as necessary to adjust for changing conditions.

Growth planning by electronic systems promotes a better balance in operations by reason of their built-in coordinating powers. Electronic systems can handle many related factors concurrently and keep them in balance; for example, such factors as requirements and available means. Such systems can help to reduce discrepancies between plans and performance. They tend to bring about efficient application of manpower to tasks; they reduce material shortages; provide balanced materials and parts inventories; improve scheduling of equipment.

Electronic equipment, for the first time, permits managers to process the symbols of engineering and business plans and transactions simultaneously with the processing of the actual things and values of the operation and to organize this flow of data in streams of symbols within the machine system instead of in a river of papers flowing through the offices. Moreover, it enables

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managers to run series of symbols ahead, in time, as forecasts of results. If the symbolic results, or forecasts, are not satisfactory, time still remains to revise "inputs"—a change in plans—to bring about better results.

Redesign Engineering Positions

An organization plan is a design. It shows how functions of the organization are grouped and related to each other, and how responsibilities for every function are assigned to specific positions. The design shows levels of authority and responsibility and the means of communication and coordination among the functional groups and positions vertically and horizontally. The organization plan or design is, therefore, structural.

As the functions and functional groups compose an organization, so positions compose each function. Positions are the "building blocks" of the functional organization units.

Structural design provides for stability and safety under load through proper, detailed design of individual structural members and their connections. Organization design provides for clearly stating what each function is and how it is articulated with other functions. Just as the functional arrangement must cover all operating requirements, leaving no gaps, so positions must spell out the details of each function in statements of duties that completely fill in the functional framework of the organization.

It is apparent that organization planning and the design of positions differ from each other only in degree or level of application. The functional responsibilities completely cover all operations of the business; the position duties, taken together, completely detail every function.

As functions change by expansion or acceptance of new objectives or as new operating methods are introduced, the positions should change also to maintain efficiency of organization processes.

Positions, therefore, are designed as structural components of organization. More important, they should be designed as rewarding and satisfying occupations for men and women. Positions should be able to pass three tests:

1. Are they in fact satisfying occupations with outlets to still better positions?
2. Can men and women be readily trained to discharge the duties and responsibilities?
3. Are the duties and responsibilities homogeneous so that compensation can be fairly evaluated?

If positions are deficient in these tests, difficulties commonly arise: high turnover, steady attrition of morale among those people who stay, poor performance due to training difficulties, and inequities in pay.

How to Go About It

Position design, then, is the technique of combining related, homogeneous

tasks into occupations that are desirable, rewarding, trainable, fairly priced, and that completely satisfy all functional and operating requirements of the organization units they compose.

Re-design of positions may be desirable because of too narrow content or too broad content. In the former case the job may be confining, tiring, monotonous. In the latter case it may cover so many things that training is too difficult. The well-designed job calls for a few closely-related skills with enough variety to be interesting. The skills should be related to one function for ease in training and supervision. They should rate fairly close together on a job-evaluation scale to prevent dilution of grade and to warrant commensurate pay.

Engineering positions can be redesigned with profit to the Highway Department and the employees. The purpose is to enable the Department to pay professional salaries for professional responsibilities, technical salaries for technical skills, and clerical salaries for clerical and related office tasks.

The most resourceful way to redesign engineering positions is to express the general, planned highway program in terms of work programs and schedules for each major organization unit. Descriptions of the work required for each work program would then be written, describing the operations necessary and the general estimate of man-days required per unit of scheduled time.

The detailed operations would then be classified and rated in a manner similar to job evaluation. Each operation would be identified with a particular labor grade.

The operations within a particular labor grade would then be grouped in "families" of similar or related skills. That is, skills that can readily be learned because they require similar education, aptitudes, training, and experience.

New jobs then can be designed to satisfy these families of related skills, with built-in variety for job satisfaction.

Finally, the kinds of new jobs and satisfactory old jobs are divided into the work programs to develop Manning Tables for each organization unit, and from these Manning Tables, Budgets of Positions are developed for management control of the force.

(Continued on page 18)

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Joining Material is Developed

The development of a joining material and new industrial technique for the chemical union of similar and dissimilar non-ferrous metals has been announced by Intertectics, Incorporated, Bedford, Ohio.

Use of this new material, called Inter-Act, is expected to create revolutionary changes in methods of joining non-ferrous metals in the aircraft, automotive, appliance, construction and electrical manufacturing industries, missile fabrication and many other types of industry.

InterAct makes commercially feasible, for the first time, the chemical joining of copper and aluminum, until now possible only by mechanical means. The new material also forms a permanent chemical bond through ion exchange between such materials as magnesium, titanium, brass, zinc, silver and gold.

The resulting joint is usually stronger than either of the metals involved, is frequently greater in corrosion resistance, and has similar electrical, physical and chemical properties.

Joints resulting from use of these materials represent a totally new concept in the union of metals. They cannot be classified as soldering, welding or brazing operations.

On some types of joints, it is estimated that industry may save from 50 to 300 per cent of its present joining costs.

This announcement is the culmination of years of laboratory research, pilot plant and field testing on the part of Intertectics, and other manufacturers interested in the end use of the product.

Intertectics, Incorporated, holds exclusive, world-wide patents on both the product and the methods of its manufacture. The material will be marketed both in the United States and abroad.

Chemically, InterAct is a reaction eutectic, that is, a material which under the influence of heat eliminates the surface oxide layer and causes similar and dissimilar metals to flow together at temperatures lower than the melting point of either metal being used.

Development of the process actually began several years ago, with the basic

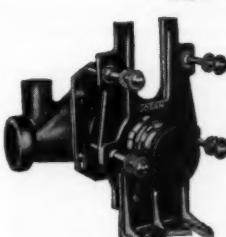
research being performed by Horizons, Incorporated, Cleveland process and materials research organization. Intertectics, Incorporated, formed in 1953, financed this basic research in 1954 and early 1955. At that point, it was believed that the long-sought answer had been found. But exhaustive tests showed that the proper level of corrosion resistance in the material had not yet been reached. Another year of research followed.

In January, 1957, Intertectics began the development of a pilot plant, and limited production of a new material of great strength and similar electrical, physical and chemical properties was started. This new material showed extremely high corrosion resistance levels, frequently exceeding those of the metals being joined.

The actual manufacturing process required equally diligent research. One of the major problems involved was how to package an intensely hygroscopic material exhibiting corrosive characteristics which on contact with moisture would quickly destroy itself and its container.

The answer came in a unique and new method of making a sheath, which is

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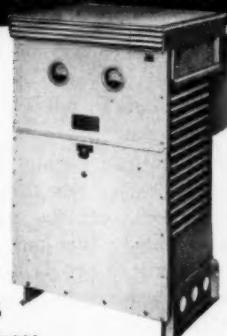
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formed as the InterAct is injected under vacuum, so that the container is completed the moment the material has been placed in the shell. Since the shell is also an integral part of the joining process, there is no problem once the material is in the user's plant, beyond the polyethylene capping of the coil tip when the product is stored.

Shelf life of InterAct is indefinite. However, powder forms must be used within a short time once a bag is broken, since hygroscopic action will otherwise destroy them.

One of the chief features of the new material is that it lends itself perfectly to automated, industrial conveyor techniques. There are three basic methods of use.

Manual operation involves the operator feeding InterAct wire into the joint, while the joint is heated with a torch. It takes approximately 2 seconds to complete the reaction, once reaction temperature has been reached. It is then fluxed with warm water to remove reaction by-products. Under such conditions, the operator must be masked.

In a conveyor operation, the materials to be joined are moved on a conveyor through an induction furnace or gas oven, heated to a temperature of approximately 810°F. InterAct, formed in $\frac{1}{8}$ -inch diameters to fit standard industrial welding guns, is fed through a mechanized gun to the joint. Reaction is instantaneous. A water spray is then used to clean the joint. A hooded exhaust system, equipped with a suction pump, located over the junction point, vents the fumes to the outside. Since the fumes are water soluble, a water spray in the tower renders them harmless before they escape to the outside.

A third industrial method is similar to the second, except that through electric strip heaters, only the areas to be joined are heated. This method lends itself particularly to pre-forming of the wire coils to fit unusually shaped joints. The pre-formed coils can be dropped automatically into place on the joint in a conveyor type operation.

Intertectics officials point out that the process can be adapted to the do-it-yourself or home market, provided that the following precautions are strictly observed:

1. Pieces to be joined must be the same metal in the same analysis.

2. Members of the joint must be of the same physical dimensions.

3. All parts to be joined must reach reaction temperature at the same time.

Biggest immediate markets for the material will be in the aircraft and guided missile fields, where joining of aluminum, titanium and copper is a problem, and in the electrical manufacturing and appliance industries, where the use of high resistance welds and complicated casting techniques can be eliminated.

Impact

Atomic energy's impact on coal production will not be significant until 1975, say officials of the Atomic Energy Commission and Department of Interior.

Air 'Brain' Advances

Latest advances in the use of electronic "brains" for defense, industry, aircraft, earth satellites, automobile control, communications industry and business was to be aired at the Eastern Joint Computer Conference at the Shoreham and Sheraton Park Hotels, Washington, D. C., Dec. 9-13. Forty-seven papers were scheduled during nine sessions. The Conference was sponsored by the American Institute of Electrical Engineers, the Institute of Radio Engineers and the Association for Computing Machinery.

Speaker at the Conference banquet Wednesday evening, Dec. 11, was E. R. Quesada, special assistant to the President for airways modernization.



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Bulldozers Borrow Idea from Airplanes

Scientists have found the solution to the problem of shock absorbers for bulldozers by looking to the sky.

"Since hydraulics and air are used in airplanes to cushion the landing shock, we decided to apply the same method to heavy earthmoving equipment," said Ralph H. Kress, manager of the LeTourneau-Westinghouse Co. truck division in Peoria, Ill.

Kress spoke at the 13th annual National Conference on Industrial Hydraulics on Oct. 17 in Chicago.

The conference was sponsored by Illinois Institute of Technology and its affiliate, Armour Research Foundation,

in cooperation with several engineering societies and more than 100 industrial organizations.

The similarity of problems between high-speed planes and earthmoving equipment resulted in the new LeTourneau-Westinghouse "Hydrair" suspension which provides for fast travel over uneven terrain with a minimum of shock, Kress explained.

The wheel suspension unit consists of only two parts, he added, a stationary cylinder secured to the frame and a moving piston secured to and operating with each wheel.

Degrees of shock absorption can be varied to suit any requirements by regulating the amount of air pressure in the chambers. The suspensions are avail-

able for wheel loads from 5,000 to 30,000 pounds, he said.

Kress explained that the whole unit acts as a giant two-way shock absorber which permits the wheel to follow ground irregularities, but "snubs" its return action to give a smoother ride.

Kress spoke at the opening day session of the two-day conference devoted to elevating the general level of technical knowledge in the industrial hydraulics field through papers and discussions.

NCIH also sponsors an educational hydraulics program at Illinois Tech.

Mechanical Breathing Equipment Valuable

Mechanical resuscitation equipment can be valuable in saving the life of utility workmen whose breathing has been stopped by accidental electrical contact.

"The cost of providing such equipment may be justified if it does nothing more than improve the awareness of electrical crews of their life saving responsibilities," T. M. C. Martin, of the University of California Berkeley, told a safety symposium during the Fall General Meeting of the American Institute of Electrical Engineers in Chicago on Oct. 8. "Entirely aside from the humanitarian aspects, industrial fatalities are costly. Most electrical utilities find that preventative measures save money."

Manual artificial respiration techniques are not entirely adequate in the special circumstances that frequently prevail at the scene of electrical accidents, he said, but there is no conflict between those methods and mechanical methods. He added that both are trying to save life.

"When a utility has provided such equipment," he advised, "it should adopt a thorough program of training all affected personnel in its effective use. It should insist that the equipment be situated and continuously 'broken-out' and tested in such a fashion that there will be a maximum probability of its being in the immediate vicinity of potential electrical contact accidents ready for use. In other words, where 'hot-line' work or work 'in the proximity' of energized equipment is under way is where the equipment may be needed. There will be no opportunity to order equipment or deliver it to needed locations after the accident."

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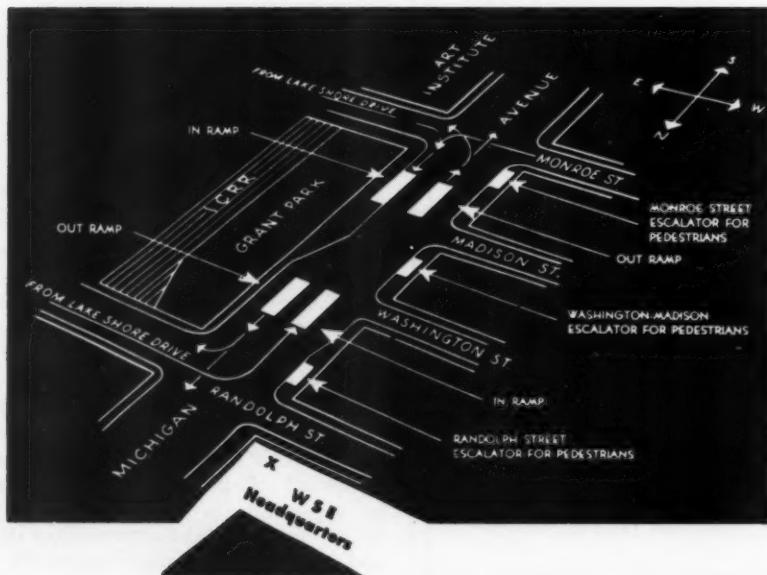
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Below: map showing Park Department Underground Garage



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International Establishes Chair

The International Nickel Company has established a chair in chemical metallurgy at Columbia University; it has been announced by Dr. Grayson Kirk, president of Columbia. Formal acceptance of the chair, which is endowed by a grant of \$350,000, was disclosed as a result of action taken in the first fall meeting of the university trustees. In addition to the basic grant, the company made a gift of \$75,000 for special expenditures incidental to establishment of the chair.

In making this grant, Henry S. Wingate, president of International Nickel, explained that the company wishes to support fundamental research in the surface chemical and physical aspects of many problems in mineral beneficiation and extraction metallurgy.

"The demands made today for improved practice in the extraction of metals from their ores, particularly necessary in a period of generally rising industrial costs, call for a better understanding of the scientific bases of this technology," said Wingate. "We hope

that this chair, the work of which will extend beyond any previous studies on the properties of interfaces, will encourage research contributions to basic knowledge in this important field."

Dr. Kirk said that the Trustees have designated the new chair at the Stanley-Thompson Chair of Chemical Metallurgy in honor of two outstanding alumni of Columbia's School of Mines—Robert Crooks Stanley, who was chairman of the board and chief officer of International Nickel until his death in 1951, and John Fairfield Thompson, chairman of the board and chief officer since that time. Stanley received the degree of E. M. in 1901 and the honorary degree of Doctor of Science in 1939. Dr. Thompson received the B. S. in 1903, the Ph. D. in 1906, and an honorary degree of doctor of science in 1950.

The Columbia Trustees also confirmed the appointment of Dr. Jack Henry Schulman of Cambridge University, England, as the first incumbent of the chair. He will begin his Columbia teaching duties immediately. Dr. Schulman, an outstanding British scientist, reader in surface chemistry at Cambridge and a fellow of Trinity Hall, Cambridge, has resigned his post as director of the Ernest Oppenheimer Laboratory in the Department of Colloid Science at Cambridge University. He has been a vice-president and a manager of the Royal Institution of Great Britain and also a Vice-President of the Faraday Society and chairman of the Colloid and Biophysical Committee. During World War II, he was a scientific advisor to the Ministry of Supply and helped to develop special weapons for the British War Office. In recognition of these services, he was appointed an officer of the Order of the British Empire (O.B.E.). Dr. Schulman was president of the Scientific Section of the First World Congress on Surface Activity in Paris and served this year as chairman of the Meetings Committee and editor of the Proceedings of the Second World Congress on Surface Activity in London.

He has been a director of the Imperial Smelting Corporation, Ltd., and scientific advisor to several large British Commonwealth mining corporations.

Dr. Kirk said that "in the School of Mines, which is a division of our School

of Engineering, this endowed professorship will be considered as supplemental to both the mineral engineering and metallurgical subdivisions. Dr. Schulman, whom we welcome as one of the most distinguished scientists in his field, will offer courses of instruction spanning both areas and will encourage graduate students to undertake research in some of the more fundamental surface problems of interest to one or both of these areas. We are especially happy that the chair will bear the names of two alumni whose contribution to their profession and to the broad community has been of inestimable value."

No More Overfilling?

A new electronic control device to prevent overfilling of oil storage tanks will soon be tested, reports *National Petroleum News*. The device will work with any product. Hook-up is made to pumps which shut off automatically when the right amount of product is in the storage tank. The device can be utilized for truck loading as well.

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Graphite Parts Get Hard Coating

"A recently developed, novel technique for placing a hard, refractory, smooth and wear-resistant coating on machined graphite parts, should be of great interest to many segments of American industry." So says Dr. Morris A. Steinberg, head of the Metallurgy Department of Horizons Incorporated, Cleveland process and material research organization.

According to Steinberg, "the new technique, which provides a carbide coating may not only better the performance of graphite parts now in use in industry, but also create new areas of application.

"Cost of the coatings, though dependent on size of application, may prove to be less than the cost of unprotected graphite, since the coatings appear to permit increased usage of the parts involved."

A broad range of possible uses for the coated parts is seen from nuclear reactors to die casting machine inserts.

The coating is integrally bonded to the graphite, and its smoothness is a function of the smoothness with which the base graphite can be prepared. Coatings are complete, even in undercuts, holes, drilled areas, milled sections and the like. Thicknesses can be varied between 40 microns and 250 microns. Above this limit, the material tends to exfoliate.

In the specified thickness, the coating shows excellent heat shock resistance and integrity under cyclic conditions. Melting point is 2000° C. or higher, with a hardness of 2000 Vickers minimum. In reducing and vacuum atmospheres, the coating is chemically stable.

The material shows a fair degree of oxidation resistance, superior to graphite, but still only nominal. However, additional work on the coating may increase oxidation resistance of the material substantially.

Steinberg notes several possible applications for the new coatings are indicated.

"In liquid reactor cores, such as the type now being constructed, uranium bismuth or thorium bismuth slurries are utilized in liquid form under a substantial head of pressure. An unprotected graphite core can absorb a substantial amount of the liquid, and impede the continuous operation of the reactor.

Carbide coated graphite may reduce or completely eliminate this potential absorption. Similar coating applications on graphite may prove useful in the process of gasification of coal, which requires a nuclear reaction and the use of graphite in the form of spheres.

"Another possible application is the coating of graphite fixtures which are used to hold honeycomb parts now coming into wide use in the construction of supersonic aircraft and missiles. These "honeycombs," sealed as a support between two layers of metal, must be soldered or brazed to the external layers in large furnaces at temperatures of

around 1800° F. To hold these parts in position in the furnace, graphite fixtures are used. During the process, the fixtures suffer severe corrosion and erosion at a rapid pace due to wear and atmospheric influences, even though the process is carried out in a hydrogen atmosphere. Carbide coatings may greatly lengthen the service life of these fixtures, while retaining all the other characteristics which make graphite useful in this application."

Containers used for continuous evaporation of metals is another application where coated graphite may be useful, according to Dr. Steinberg. These vessels, usually constructed of silicon carbide, metal or even graphite, often

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quickly fail because of chemical attack by the molten metal being evaporated, or absorption of the metal into the pores of the container. Coated graphite containers may be an answer to this problem.

Another area of potential study is the replacement of silicon carbide inserts in the die casting of aluminum and copper alloys with coated graphite inserts. Silicon carbide, used in this application to maintain temperature control, is almost impossible to machine. Graphite, on the other hand, is an easily machined material.

Steinberg concludes that "while basic research on the coating and process of application have been completed, specific application studies yet remain to be undertaken.

Atomic Industrial Plants to be Safer

Atomic industrial plants of the future will be safer to work in than conventional plants of today, predicted John F. Ege, Jr., director, Industrial Hygiene and Safety Division, Argonne National Laboratory.

Ege spoke Oct. 10 before the Chicago Association of Commerce and Industry's annual fire prevention week luncheon, at the Sherman Hotel.

He said the three main areas of industrial application of atomic energy will be power reactors, radioisotope production and use, and fuel fabrication and reprocessing.

"Workers in these fields," said Ege, "will be safer on their jobs than those

who are now employed in many industrial plants."

This conclusion, he said, is based on experience to date, which shows absence of accidents caused solely from the fact that materials handled were radioactive.

In other words, accidents involving radioactive materials can be traced to the same causes as those of conventional mishaps; human error, and lack of technical skill.

"Technical skill will increase," he said, "as unusual safety problems are met and solved."

Ege pointed out several areas in the atomic industries of the future where new safety problems may occur.

Those working in fabrication and reprocessing of fuel will have to solve problems involving possible chemical fires.

"Exposure incidents," he said, "could occur in atomic shipbuilding, conversion or maintenance."

On the other hand, he said, there should be a minimum of safety problems in power reactor plants, because reactors operate in much the same manner as conventional power plants.

"Employees who work in chemical separation and processing plants will be well protected, and well trained by experience," he said.

"Perhaps the largest human exposure," Ege continued, "may come from working with radioisotopes. But in time, personnel will learn to handle isotopes with no resulting contamination or exposure incidents. Although," he added, "there will be times of urgency when internal or unknown contamination of persons is suspected."

Argonne's safety record, said Ege, has shown that exposures to radiation have been well controlled.

"There is no reason to believe," he concluded, "that this kind of experience should not be the rule for future isotope workers."

Argonne National Laboratory is operated by the University of Chicago under contract with the U. S. Atomic Energy Commission.

Aerosol Sets Record

Aerosol sales in 1956 set a new record, 320 million units, reports *Chemical Week*. The products, valued at \$320 million, totaled more than 33 per cent above the 1955 sales mark.

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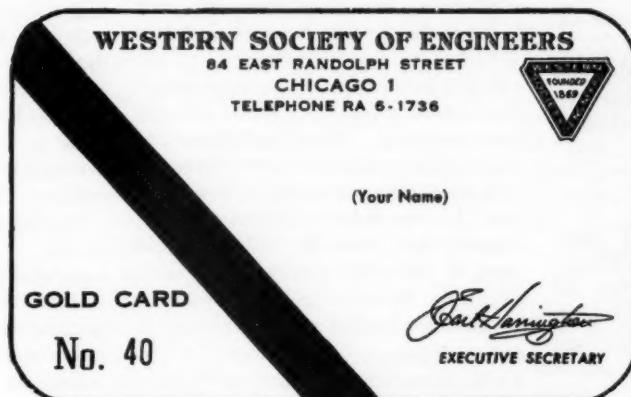
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Highway Programs

(Continued from page 8)

The result of this procedure will be a group of positions that have adequate job satisfaction, homogeneous job content, requiring skills of similar value in the market, undiluted by subordinate duties, and not complicated by frustrating duties much above the normal in complexity.

One can then afford to pay the rate for top skill in every job because the top skill is the same as the normal or customary skill for all of its duties.

Improved Personnel Administration

If positions are well designed salary administration and personnel administration are greatly simplified. They are simplified because well-designed positions are clearly-defined, valuable, and fairly-priced "packages" in the personnel market.

Personnel administration, as a management function, is directed toward one thing: conservation of investment in personnel staff. Executives, supervisors, engineering specialists and workers of lesser skills possess an aggregate of experience and skills that is truly a valuable investment. Any practice or procedure that conserves this investment for a longer time reduces the cost of personnel administration. Any practice or lack of foresight that results in high turnover, personnel unrest, errors, and grievances, is a waste of investment values.

Control of Personnel Costs

Personnel costs are a compound of salaries and wages and the varying costs of personnel administration. Both of these classes of costs can be controlled within predetermined limits by means of management techniques.

Very briefly, here are some examples:

1. Comparative salary and wage surveys measure the competitive limits of pay rates. Procedures for regional and national pay data surveys have been perfected by research and proved by years of practice. They should be invaluable for state highway departments.

2. Position specifications and position design techniques are applied in establishing the optimum assortment of duties for individual positions.

3. Position evaluation tends to eliminate inequities in pay and should provide a progression of jobs for employees

who are growing in experience and knowledge.

4. Merit reviews and performance rating can help to place and maintain employees equitably within the minimum and maximum rates of their labor grade.

5. All of these techniques help to reduce high turnover rates, increase job satisfactions, morale, and loyalty—and therefore they reduce the administrative cost of every payroll dollar.

6. For every requirement of personnel administration there is a tested management technique. These techniques are engineering in nature and are therefore pointed toward satisfying each requirement in an orderly, logical manner, drawing upon scientific and operations research methods wherever they may serve best. Research in salary administration techniques is most rewarding.

Other Administrative Techniques of Promise

The availability of labor-saving techniques and the newer ways of redesigning and enlarging positions create new administrative problems as they help to solve older problems. These are powerful "tools." They force changes in jobs and changes in departmental functions. They offer opportunities for more effective management controls as well as require better communication among executives because of their great power.

So more research is needed in administration. The problems group themselves into four classes:

Organization Planning
Staff Development
Management Controls
Management Reports

The Economics, Finance, and Administration Department of the Highway

Research Board and its Project Committees have done good work in these fields. The need appears to be for "more of the same" and this "more" fitted to the differing requirements of the various states.

Organization Planning

Organizations should be planned to get the job done most expeditiously under appropriate standards of design and cost. There may be a tendency to draw an organization chart first and allocate personnel and tasks to the various blocks on the chart according to some preconceived pattern. This won't necessarily get the job done expeditiously.

Notable reductions in operating expenses, improvement in field service, more disciplined technical performance, and more effective top management have resulted from applied research in organization and districting problems.

Reasons for Organization Planning

Reasons for making organization studies have varied: Expenses had to be cut; field activities had to be expanded or better controlled; engineering standards had to be enforced or made more flexible; executive bottlenecks were holding up action, or trouble was developing between jurisdictions of division executives at headquarters and district supervisors who "just want to be let alone and get the job done."

General Method

The research method is to study the territory, location of personnel, plant, and equipment, work distribution both geographical and in time, communication and travel facilities, and requirements for administration. There is an optimum way to put all of these elements together.

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The Problems

The problems involved in doing this include the following, among others:

1. How to decentralize authority to the level where action must be taken in response to local demands and yet retain standards and operation discipline.

2. How to harmonize the relative needs for district self-sufficiency and central control.

3. How to make the "authority of knowledge" effective in the districts through "functional" supervision and yet reduce the probability of conflicts in this relationship.

4. How to promote standardization throughout the districts and yet retain the advantages of varied innovations and experimentation.

5. How to disseminate information from headquarters and know what the districts are doing with minimum demands on executive time.

6. How to determine whether an activity can most profitably be centralized or decentralized.

7. How to maintain team play and promote solidarity throughout a far-flung organization by organizational means.

Check Points for Organization

Some check points for effective organization planning and districting are:

1. Complete, flexible, and responsive coverage of the territory for the desired quality of services from the point-of-view of highway users.

2. Effective management control of programs, projects, operations, and results.

3. Maximum availability throughout the territory of the highest knowledge and experience expressed in the form of policies, regulations, budgets, stand-

ards for design, construction, maintenance, and operation; and counsel based on all of these.

4. Minimum dilution of executive instructions and answering reports by their passing through levels of authority and channels of communication.

5. "Horizontal" coordination of functions built into the organization plan.

6. Adequate technical and administrative staff services provided for top executives.

Staff Development

Organization planning is concerned with keeping the structure of the organization in line with developing requirements. Organization structure is relatively static. The dynamic counterpart of organization planning is Staff Development.

Here a good job is being done. Many states have active recruiting, educational, and training programs under way that promise to bring more young people into highway careers and help them to develop themselves there.

New sources of technicians are being found in high schools. Cooperative, "Work-and-Learn Programs" are being sponsored jointly by highway departments and universities. Internal training programs within the state departments serve to orient the engineering graduate and speed up his professional training on the job.

In the upper levels of staff development, less work is being done than may be desirable, but as the recruiting and educational plans bring in more adequate numbers of qualified young men, there will be more material to upgrade into executive positions. Then executive development plans will pay off better

than they do now because present "plans" of this nature are usually crises instead of plans.

Management Controls

Management controls are administrative techniques designed to limit the deviation between important plans and performance.

The essence of management control is the authority, willingness, and ability to regulate an operation according to a desired or imposed standard. The procedure is the keeping of deviation from standard within permissible limits. Therefore, a system of management controls presupposes the existence and common knowledge and acceptance of:

1. Department objectives
2. Department general program for highway development
3. Clearly-defined and published engineering standards, including maintenance.
4. An organization plan whereby responsibilities are fixed for all administrative and operating activities.

Typical Controls

Some basic management controls are defined below:

General Planning Control

This control is largely a delineation of progressive stages of the State's highway system supported by schedules of funds, manpower, materials, etc., required for each stage. A coding system should reference specific projects to the various planning stages.

Organization Planning and Control

As the department's responsibilities grow, organization planning must anticipate and provide for the changes in functions and the new positions. Here it is necessary to chart the developing organization and key it to the highway program.

Staff Control

Development of supervisory and executive personnel to fill the expanding organization must be planned and controlled and phased into the highway program. This is a job of planning and dating the succession for every managerial position in the department.

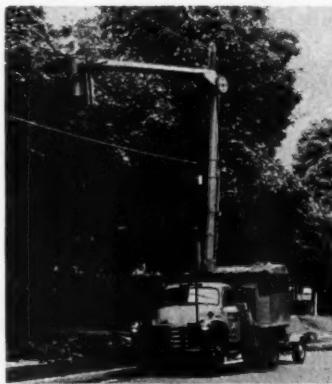
In addition, a Manning Table should support every phase of the developing highway program. From these Manning Tables, forecasting personnel requirements, the Personnel Director takes his

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cue and recruits and trains his work forces.

The management control report for staff is a Budget of Positions based on the program's requirements at the time and comparing staff requirements and actual staff employed on the regular payrolls and temporary payrolls.

Fund Control

The summation of expenses for the various phases and projects of the highway program, as may result from an electronic calculator application, gives the fiscal requirements for the program. Available funds are also known. Control of allocation and use of funds is the management technique that matches the money with the task.

A Fund Allocation and Use Report will give the Chief Engineer the over-all fiscal picture of operations and expansion that he needs to keep his requirements before the Commission.

Design Control

Engineering standards are in existence. Control of these standards involves a continuing adjustment to funds available and the increasing technical demands of the roads themselves and the people that use them. Even engineering standards are fluid in these times.

Control of standards also involves the question of adjusting them to particular local conditions which may or may not be commensurate with the design norm when the standards were established. There must be a record of allowed deviations from standard.

Control of engineering standards also implies inspection for compliance.

All of these requirements must be satisfied by the control plan and management reports must inform on compliance and deviations.

Expense Control

This is budget procedure, coupling money allocated and spent to results obtained. It should be a "performance budget" as well as an expense budget. The expense estimate would flow directly from detailing of programmed projects. The actual expenses would come from expenditure statements and results. The management control exists in examination of variances (with their explanations) and trends and the taking of action such as may be appropriate.

Materials Control

Specifications for materials are engineering standards. Tests are controls of

engineering standards. This can be reported on in the form of compliance and deviation reports as for design and construction and maintenance standards.

The other phase of materials control is the keeping of inventories at the economic level. Formulas exist that are useful in maintaining economic balance between procurement and handling costs. Easily-read charts are available to make this control simple. Management control reports of inventory usually result in releasing some slow-moving working capital to operations.

Maintenance Control

A very fine over-all control of highway capability exists in the Sufficiency Rating Study Plan. Maintenance is reflected in these ratings and, because of this, the plan can integrate over-all maintenance with highway system planning.

In more detail, management control reports on maintenance should be made by districts. Here again, good management reports cannot be made until the maintenance standards are known and honored and a maintenance schedule is adopted. Then adequate reports can be made, comparing conditions with the standards and status of work with the maintenance schedule.

Plant and Equipment Control

Plant and equipment can be controlled in relation to the uses expected of it only if its various capabilities are known. The uses are expressed in program requirements.

Once the equipment is available, it must be maintained and this control is based on effectiveness vs. the cost of maintenance.

Management Reports

Management reports are the tools of management control. As a class they are

now inadequate because they usually are not complete, not integrated, and not comparative. Reports of simple, figure-facts are not good management tools. Management reports must carry a message, an indication of normal or abnormal status; plus or minus performance. They should say to the executive, variously:

1. "This activity is up to your expectations; dismiss it from your mind."
2. "This project is lagging, by so much; better expedite."
3. "The trend of this statistic has reversed itself; better check."
4. "This function is being directed with great energy and fine results; capitalize on it."
5. "This index forecasts a need for giving increased attention to car inspection."

Requirements for Management Control Reports

Accuracy: Information must be true or representative within acceptable margins of error.

Timely: Information must be furnished while time for corrective action still remains.

Concise: Meaning must be readily apparent without requiring analysis or long reading time.

Comparative: Results must be presented not only in magnitude, but more important as variances from a standard of performance; that is, a desired value or trend; a budget; a bogey.

Explanatory: Reasons for deviations from standards should be shown.

Indicate Action: Should recommend a course of action or a decision or possible alternatives in executive action.

Understandable: Should make use of technical devices of good communica-

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tion, such as statistical correlations, parallel tabulations, graphs, and ratios. Sometimes it pays to read reports to executives or project them on a screen for exposition and discussion.

Research the Key

Research is, then, the key to betterment of highway programs—more and broader research and speedier and more effective applications in practice.

As has been said, the idea of research is accepted. Research is organized and well led. The problems arise in making practical and economically-sound applications to the many, differing conditions, both physical and managerial, in the state highway departments.

Identifying these problems is a top administrative responsibility and because it is—research in administrative methods, organization planning, and staff development appears to be the most promising avenue for research today.

Papers on Missiles Will be Presented

Three presentations on guided missiles and an open panel discussion on reliability definitions will highlight the Fourth National Symposium on Reliability and Quality Control to be held Jan. 6-8 in the Hotel Statler, Washington, D. C. The symposium will be sponsored jointly by the American Society for Quality Control, the American Institute of Electrical Engineers, the Radio Electronic Television Manufacturers Association and the Institute of Radio Engineers.

The guided missile papers are: Systematic Methods in Missile Seeker System Design by H. V. Cooper, Bendix Aviation Corp., Jan. 6; Test Program Design for a Missile Guidance System by R. P.

Grant, American Bosch Arma Corp., Jan. 8; Talos Missile Data System Contributes to Management by R. R. Wendt, of the Bendix Aviation Corp., Jan. 8.

More than 40 other papers by authors from industry, the military and government and the panel discussion moderated by C. M. Ryerson of the Radio Corporation of America will comprise the remainder of the technical program.

Keynote speaker for the meeting will be Major General F. L. Ankenbrandt, U.S.A.F. Rtd., of the Defense Electronic Products Division of the Radio Corporation of America.

A banquet will be held on Jan. 7. Lawrence N. Hyland, vice-president and general manager of the Hughes Aircraft Company will deliver the major address, "The Challenge of Reliability to Management." The National Reliability, IRE Professional Group on Reliability and Quality Control, and the American Society for Quality Control in Electronics Division awards will be presented during the banquet.

Three separate tours will be held each morning. One will be to the Naval Ordnance Laboratory, another to the Potomac Railroad yard at Alexandria, Va., and the third to a National Broadcasting Company radio and television station.

Cooperation

The Nebraska State Highway Department is going into the relic-hunting business, reports *Engineering News-Record*. The Highway Department will furnish the State Historical Society with plans for every proposed road job. The department also has instructed crews to watch for relics, and to avoid destroying historical items such as ruins, sites, artifacts, fossils or objects of antiquity.

Shippingport Station Compares Favorably

The Shippingport Nuclear Power Station near Pittsburgh, Pa., will have "about the same load response and maneuverability as a conventional fossil fuel plant operating on a utility system."

Such was the gist of a paper, "Load Control for the Shippingport Nuclear Power Reactor," presented on Oct. 8 in Chicago at the Fall General Meeting of the American Institute of Electrical Engineers.

"The start-up and shut-down times compare favorably with fossil fuel type plants, H. A. Van Wassen, of the Duquesne Light Company, Pittsburgh, reported. "The response of the nuclear heat source will not be a limiting factor for load changes which are beyond the design load limits of this plant."

The Shippingport Station, scheduled for completion this year, is the only full scale electric power plant in the Five Year Power Reactor Development Program proposed by the United States Atomic Energy Commission in February, 1954, he said.

Although the plant utilizes an unusual heat source—a nuclear reactor—the control of the output of the 100,000 kilowatt generating unit will be similar to that of a conventional station, Van Wassen said.

He observed that the initial capacity of Shippingport would be considerably lower than the 150,000 kilowatt reserve capacity of the Duquesne Light Company's 1,207,000 kilowatt system, hence loss of Shippingport due to forced outage would pose no very serious problem for the rest of the system.

New Helicopter Flies For Drilling Crews

The world's largest commercial helicopter, designed to provide transportation of field crews and heavy equipment in off shore and other drilling operations, has been introduced to the oil industry, reports *Petroleum Week*. The new chopper can carry a 25 per cent higher payload over a 100 nautical mile radius than earlier military models now in use. The helicopter can cruise at 88 knots, has a range of 315 miles and a service ceiling of 10,600 feet.

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TECO Celebrates 25 Years

Twenty-five years of continuous service to the lumber and wood products industries in research and engineering was celebrated by Timber Engineering Company at its silver anniversary Directors' meetings in November, according to Harry G. Uhl, president.

Organized in January, 1933, as an independent, incorporated affiliate of the National Lumber Manufacturers Association for the purpose of promoting the use of wood through modern engineering practice and research studies, Timber Engineering Company has achieved a leading position in the fields of timber engineering and wood product development.

Teco, as it is popularly known, introduced modern timber connectors into American construction, opening the way for far greater use of wood as an engineering material. The Teco system of engineered timber construction is widely used today in residential, commercial, recreational and industrial buildings, schools and churches.

For a quarter century architects, engineers, professors and student designers have been supplied with the latest technical data developed by Teco's continuing research and engineering studies. These developments have revolutionized the concepts of timber design procedures and construction practices. Builders and lumber dealers have also received practical information on building better and more economical wood structures.

In 1943, the Timber Engineering Company wood products laboratory was opened, expanding the scope of its services, to provide needed research and testing facilities for lumber and wood product development and improvement. To keep pace with the increased need for these services, four major expansion programs of laboratory plant and equipment have been necessary.

The latest expansion program completed in 1956 included a fully equipped wood particle board pilot plant and companion facilities. The plant is capable of developing and testing any kind of platen type particle boards, with companion facilities and personnel for testing both platen and extrusion boards, raw materials, production processes, end uses and markets. Custom built and conveyorized to simulate a mass producing

commercial plant, the facility is the only one of its kind in type and scope in commercial laboratories in the Western hemisphere.

A crowning achievement of the wood industry-owned service organization is the *Timber Design and Construction Handbook*, the first master compilation of the essential basic information needed to design and build in timber. The 622-page reference is the work of four and one-half years by twenty-six leading specialists in the wood industry. The book was co-ordinated and edited by Ralph H. Gloss, senior engineer of Timber Engineering Company. It is designed for use by engineers, architects and other designers, as well as professors and students of these fields.

Transistor Repeaters

"Unprecedented service demands" on telephone companies have resulted in the development of miniature transistorized repeaters to serve as an economical means for the extension of transmission ranges. Known as negative impedance type repeaters, they also permit the reduction of cable gauges in telephone company local offices.

This was the report of A. S. Howell, of the Stromberg Carlson Company, Rochester, N. Y., in a paper prepared for presentation before a session on wire communications during the Fall General Meeting of the American Institute of Electrical Engineers in Chicago on Oct. 10.

The electrical function of the repeaters, which are of the series and the

series-shunt type, he said, "is to provide transmission gain when inserted in a two-wire telephone line. Provisions for gain adjustment are adaptable to all line facilities normally found in the telephone outside plant. The circuit design is such as to minimize changes in gain over the range of expected environmental conditions."

The repeaters were developed in miniature form, Howell pointed out, because demands for new facilities often create serious space problems, particularly when required equipment must be installed in existing bays. The miniaturization of the repeaters is made possible by circuit application of the versatile transistor as the active element in conjunction with printed wiring board techniques. They are entirely powered from 48 volt central office battery, eliminating any need for bulky power supplies. The plug-in units constitute compact, light weight but rugged equipment enclosures and are readily manufactured. Overall circuit shielding is accomplished and all components are accessible.

These features, said Howell, make for compact packaging and may also prove advantageous in the packaging of other equipments.

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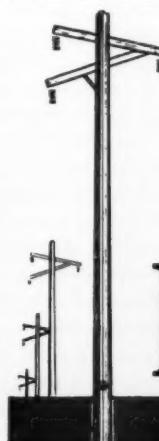
Gasoline pumps soon may be set automatically to fill a customer's exact needs, reports *National Petroleum News*. Although present pumps can automatically give full tanks of gasoline, the new ones can be set for a specific number of gallons or dollars' worth. If the customer's estimate is wrong, the nozzle will guard against overflow.

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Reviews of Technical Books



Thermodynamics

Thermodynamics for Chemical Engineers, by Harold C. Weber and Herman P. Meissner, John Wiley & Sons, Inc., New York 16, N. Y. Second edition, 1957. Pages, 507. Price, \$8.50.

Although this second edition of *Thermodynamics for Chemical Engineers* is considerably expanded, the book nevertheless retains its original approach: thermodynamics from the standpoint of both engineer and physical chemist.

A nearly 50% enlargement of the text accommodates up-to-date information on power cycles, engines, refrigerators, and fluid flow. The new edition also contains solved illustrative problems. The changes result in a more comprehensive coverage of principles and applications, and permit a readier translation of findings from chemical laboratories into the economic production methods of the modern industrial plant.

Present chapter headings include: terms and general concepts; first law of thermodynamics; equilibrium; properties of pure materials; open systems; heat capacities and heats of reaction; perfect gases; generalized PvT relations; the second law; the entropy; work functions; and flow of fluids. Additional chapters cover: engineering applications of fluid flow; power cycles; engines and turbines; refrigeration; fugacity and activity; solutions; homogeneous equilibrium-gaseous systems; heterogeneous equilibrium; effect of temperature on chemical equilibrium; state properties; phase equilibrium in multicomponent systems; and electrochemical effects.

The authors are professors of chemical engineering at the Massachusetts Institute of Technology.

Ideas and Inventions

Ideas, Inventions, and Patents: How to Develop and Protect Them, by Robert A. Buckles, John Wiley & Sons, Inc., New York 16, N. Y. 1957. Pages, 270. Price, \$5.95.

This is a readable, expert account of patent matters for all fields of science and technology.

With accent on the "how to," Mr. Buckles delves into all aspects of the problems encountered by inventors and technical management, giving principles and procedures that will insure genuine protection for minds at work in home or business. Each principle as it appears is accompanied by both good and bad practices, given as examples. For the guidance and instruction of new or prospective inventors who have had no previous experience with the Patent Office or with patent attorneys, the author has written an entire chapter, giving a complete case history. This begins with the time the inventor first made his invention and follows him from the filing of his own patent applications, his trouble with the Patent Office, his realization that he needed legal assistance, his consultation with an attorney, and through all the steps taken to rectify past errors until a patent was finally issued.

Minus technical jargon and free of footnotes, *Ideas, Inventions, and Patents* first distinguishes ideas from inventions, and goes on to clarify what patents are, what inventions consist of, and how ideas may be developed into inventions and patents. Specific information is given on who may get a patent, what exactly an invention is, how to plan a patent program, how to keep records for patent protection, the role of the patent attorney, what the patent office does, and what can be done with a patent once it is issued.

Buckles goes on to show, in the chapter "Interference — What it is, How it Comes About, and What is Required to Win," what to do when snags occur. A succeeding chapter supplies practical information on licenses, assignments, and shoprights, showing further what the inventor can and cannot do to capitalize on his work.

The final chapters explain how to read and understand patent claims and recognize infringement; confidential disclosures, trade secrets, and unfair competition; and designs, copyrights, and trademarks. Pertinent points are illustrated throughout with patent drawings, court statements, and comments designed to simplify and clarify the text. A final glossary gives legal terms and definitions, while an appendix gives samples of necessary forms and patent office drawing symbols.

Mr. Buckles, a graduate electrical engineer (Purdue, 1939), with an LL. B. from Fordham University, is now a member of the New York Bar and is with the law firm of Blair and Spencer.

Heat Transfer

Elements of Heat Transfer, by Max Jakob and George A. Hawkins, John Wiley & Sons, Inc., New York 16, N. Y. Third edition, 1957. Pages, 317. Price, \$6.75.

Principles and their applications to simple problems remain the book's case, with the newer material added as modern usage suggests. The final chapter on mass transfer is entirely new, and discusses the similarity between heat and mass transfer. Among the other "news" are: a table on thermal conductivity of liquid metals; a section on the use of equivalent circuits for the solution of heat transfer problems; additional material for the analysis of engineering systems; and sections that cover the heating of liquid metals in turbulent flow-through pipes, the hydrodynamic and thermal boundary layers, convective heat transfer at higher velocities, and the analogy between electrical and thermal circuits for convective heat transfer.

Further additions from Chapter IX on include a section on heat exchanger effectiveness to supplement earlier material on heat exchangers, and information on the differences between nucleate, partial film, and film boiling. A section on gas radiation has also been added to this edition. The revision has also occasioned the omission of the word "insulation" from the former title as well as some figures dealing with this subject.



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News of Engineers

A. Norman Laird on Dec. 1 became a partner in the firm of Plumb, Tuckett and Pikarsky, consulting engineers and architects. Mr. Laird is the retired chief engineer of the Grand Trunk Western Railroad. Among other duties he will have responsible charge of the firm's Michigan office.

* * *

Leonard J. Koch has been appointed to the newly created post of deputy director, Reactor Engineering Division, at Argonne National Laboratory.

The promotion was announced by Dr. Bernard I. Spinrad, director, reactor Engineering Division.

Koch formerly served as associate director of the division.

This Division at the nation's senior atomic energy research and development installation is charged with design and development of new and advanced types of nuclear reactors.

He entered the Laboratory in January, 1948, as an Associate Mechanical Engineer.

Before coming to Argonne, Koch worked on aircraft engine projects at the Dodge-Chicago plant and Jack and Heintz, Inc., of Cleveland.

Koch is chairman of the Program Committee for the American Nuclear Society and also serves this group as a member of its Planning and Coordination committee. He is Vice-Chairman of the Program Committee for the Nuclear Engineering and Science conference to be held at Chicago's International Amphitheatre March 17-21, 1958.

* * *

An Argonne National Laboratory chemical engineer is flying to Turkey to advise the Turkish government on its nuclear reactor planning.

He is Leonard E. Link, associate chemical engineer in the reactor engineering division at Argonne.

Link was scheduled to leave the United States Nov. 20 for Ankara and Istanbul.

He was selected to make the study trip to Turkey by Dr. Norman Hilberry, Argonne director. The Turkish government had requested nuclear reactor

planning assistance from the U. S. Atomic Energy Commission, which in turn relayed the request to Argonne.

"I have been asked to advise the Turkish government on specifications and site selection for a research reactor that it hopes to build soon," said Link.

Link planned to return to Argonne before Christmas. He is the author of a widely-read economic study of Argonne's Experimental Boiling Water Reactor.

* * *

Lawrence A. Roe, manager of process engineering for International Minerals & Chemical Corporation, has been promoted to director of central engineering and will direct the company's programs in construction, process and general engineering.

Before coming to IMC in 1955, he was in the engineering departments of Jones & Laughlin Steel Corporation and the American Potash & Chemical Corporation. A graduate of the Missouri School of Mines, he later did graduate engineering work at the University of Wisconsin.

Mr. Roe is a member of the American Ceramic Society, the American Institute of Mining and Metallurgical Engineers, and the Canadian Institute of Mining and Metallurgy. He is the author of a recently published book, *Iron Ore Beneficiation*, as well as several technical papers. He holds two U. S. patents.

* * *

The appointment of Thomas E. Long

as Assistant to the Vice President for Promotion of the Portland Cement Association has been announced by James D. Piper, Vice President for Promotion.

Mr. Long joined the Association in November, 1947, as Assistant Manager of the Farm Bureau, and became Manager the following August. Prior to joining the Association, he served for three years as agricultural engineer in the Commercial Research Division of Republic Steel Corporation. From 1939 to 1944 Mr. Long was on the staff of the North Dakota State College, where he was responsible for the development of an irrigation experimental research farm.

He was graduated from the University of Nebraska with a B.S. degree in agricultural engineering, and has since completed additional structural, highway and sanitary engineering studies at the Illinois Institute of Technology. He is a member of the American Society of Agricultural Engineers and a registered professional engineer in North Dakota.

* * *

Louis F. Kotula of Glen Ellyn, Illinois, was recently appointed a sales engineer for the Chicago Office of B-I-F Industries, Inc., of Providence, R. I.—manufacturers of an extensive line of meters, feeders and controls for industrial and municipal installations.

Mr. Kotula received his BS degree from the University of Illinois in 1942 and has had several years training in business management. He is a registered professional engineer, state of Illinois, and has been a staff engineer in charge of sales and estimating, and a purchasing agent before employment at B-I-F Industries.

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Liners Give Concrete Textures, Patterns

An almost limitless variety of new textures and patterns for concrete surfaces has been made possible by development of plastic and rubber form liners. A new publication from the Portland Cement Association says the liners produce sharp, crisp patterns and a smooth, almost glassy surface that requires no cleanout, grinding or finishing.

The liners are also satisfactory for facing concrete block, producing either a pattern for variety in wall surfaces or a smooth, glossy surface much like glazed block.

Some textures in rubber liners are already available in stock. Almost any pattern can be made to order in plastic liners. Best results are obtained when the patterns are no deeper than $\frac{1}{2}$ inch and edges and corners are rounded.

Both the plastic and rubber form liners are relatively low in cost, are reusable many times if handled carefully, need no form oil or bond breaker, and cut finishing costs to almost nothing. No special concrete mix is necessary to achieve good results, and both lightweight and heavyweight aggregates are suitable, according to PCA. Both textured and patterned liners can be used successfully for horizontally precast panels, but only the textured liners have so far been used in vertical cast-in-place construction.

Direct Current Grows In its Importance

Direct current, in the early days the accepted electric power, but largely supplanted by alternating current in the past 75 years, is growing in importance, the Fall General Meeting of the American Institute of Electrical Engineers was told in Chicago on Oct. 7 by W. A. Munson, Westinghouse Electric Corp., East Pittsburgh.

He said in a technical paper that all trends indicate that the use of DC is growing and will continue to increase, not only in kilowatt consumption but through more applications, leading to the great importance of properly planned systems.

"As our economy continues to expand and production increases," he said, "the use of DC power will grow at an ever-

increasing rate. The growth of power use will demand more economical systems, both as to distribution and as to generation.

"The use of more economical distribution systems can be seen in the increasing importance that is being placed on them by management, both as to reliability and as to efficiency. The need for higher rated and more efficient sources of DC power can be seen in the vast amount of research that is being done to obtain better, smaller and more efficient units. The future will undoubtedly see fairly widespread use of the semiconductor rectifiers, such as germanium, and silicone, as these devices offer the possibility of larger rated power sources from physically smaller units."

New Polyethylenes Give Startling Results

Development of high density polyethylenes having higher tensile strengths, higher temperature resistances and greater rigidity has resulted in an improvement of properties which have startling results from the standpoint of structural fabrication.

Writing in a recent issue of American Agile Corporation's external house organ, *Plastic Weldor and Fabricator*, company president Dr. J. A. Neumann states that "tensile strength of the new polyethylenes can be as high as 6000 psi, compared with a maximum of 2000 psi for low density polyethylenes produced by previous conventional methods.

"The new HT (high temperature) polyethylenes also show much greater rigidity, opaqueness under draw, and a resistance to continuous temperatures of 250° F. Superior stress cracking resist-

ance and burst strength are also indicated."

Neumann adds that "the property improvements open the door to new and broader applications for HT polyethylenes. Self-supporting structures can be fabricated in thinner, yet stronger sections, with weight reductions in similar fabrications of approximately one-half over conventional polyethylene components. And, weight reduction will prove of special importance in the fabrication of ducting, centrifugal blowers, stacks, hoods, and other ventilating equipment."

In the fabrication of process vessels and tanks, self-supporting structures can, in many instances, replace polyethylene liners which formerly were the most economical way of preventing corrosion, he continues.

It is also noted that steam up to 20 psi gage pressure can be tolerated without appreciable dimension variation in HT polyethylenes, which means the material can be used for such products as food processing equipment, hospital laboratory beakers and containers, and the like.

"Thus, HT polyethylenes," according to Neumann, "can replace many of today's more expensive materials, resulting in products which cost less, perform better, and require less maintenance."

First Shipment

A tank car loaded in Baton Rouge, La., shipped to New Orleans by rail, and then lifted onto a sea ferry for the trip to Havana, was the first tank-car shipment of antiknock compounds ever to go to a refiner overseas, reports *National Petroleum News*. The cranes that lifted the tank-car were big ones. They had to be—the car weighed about 40 tons, loaded with 6,000 gallons of compound.

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WSE Applications

In accordance with Article I, Section 5 of the By-Laws of the Western Society of Engineers, there is published below a list of applicants for admission received since the last issue of the MIDWEST ENGINEER magazine.

Frank Montford Fucik, President, Water Seals, Inc., 9 S. Clinton St.
John H. Harding, Draftsman, Sargent & Lundy, 222 W. Adams St.
Norman P. Smith, Design Engineer, A. J. Boynton & Co., 111 N. Wabash Ave.
Roger D. Werner, Assist. Equip. Engr., Illinois Bell Telephone Co., 208 W. Washington St.

Henry Berolzheimer, Automotive Equip. Engr., City of Chicago, Bureau of Equip., 306 W. 37th St.
Marvin A. DuBois, President, DuBois Engineering & Mfg. Corp., 6805 McCook Av., Hammond, Ind.
Rolland C. Hamm, Field Engineer, American Institute of Steel Construction, Inc., 53 W. Jackson Blvd.
John F. Aberson, Engineer, Gerhardt F. Meyne Co., 308 W. Washington St.
R. L. Selbe, Supvr., Gypsum Board Res'h., United States Gypsum Co., 1253 Diversey Pkwy.

Candela Speaks at Construction Meeting

Felix Candela, Mexico's foremost architect-engineer-builder, was a featured speaker at the Third National Construction Industry Conference, Dec. 11 and 12, at the Congress Hotel in Chicago.

Sponsored by Armour Research Foundation of Illinois Institute of Technology, the two-day meeting included discussions on forms, materials, methods, and applications by leading authorities in each field.

"Creative Trends in Structural Design" was the theme of the 1957 meeting, according to conference chairman Dr. Robert L. Janes, assistant manager of the ARF mechanical engineering research department.

Internationally-known architect Ludwig Mies van der Rohe, head of the architecture department at Illinois Institute of Technology, welcomed the some

500 engineers and architects who attended the conference.

Candela's talk concerned "Hyperbolic Paraboloids," in particular the thin concrete umbrella roof which he introduced and which is being used on industrial buildings, public markets, and churches in Mexico.

New Span Record

Setting a new span record for all-welded plate-girder construction in the U.S., a New York Thruway viaduct spans 234 feet across the Erie Railroad near Suffern, N.Y., reports *Engineering News-Record*. It is believed also to have set a world mark for girders of the single-web type. The long span was necessary because of track congestion below.

Worried?

A recent check on what individuals worry about disclosed that 43 per cent worried about finances and wages, 30 per cent, personal problems, 24 per cent, health. What about world problems, war, atomic bombing? queries *American Machinist*. Only eight per cent worried about those, and mostly for fear of being drafted or having a son drafted.

Engineering Center Plans Are Released

Plans for a new \$10,000,000 United Engineering Center to be erected on United Nations Plaza between 47th and 48th Streets, New York City, were announced Nov. 22.

The new building will serve as the headquarters of sixteen National Engineering Societies with a total membership of about one-quarter of a million engineers.

The new building will replace the present Engineering Societies Building at 29 West 39th Street which is now inadequate in view of the tremendous growth of technology since the building was first occupied 50 years ago.

Announcement of the plans was made by Dr. Mervin J. Kelly, president of Bell Telephone Laboratories, who is serving as chairman of the industrial campaign to raise funds for the new Engineering Center. Dr. Kelly's announcement featured the launching of the fund drive at a dinner meeting at the Waldorf-Astoria attended by Hon. Herbert Hoover, HMWSE, honorary chairman of the campaign; Alfred P. Sloan, Jr., honorary vice-chairman; and more than 100 leading industrialists and educators from all parts of the country.

Present plans call for the occupancy of the building in the fall of 1960. It will be a twenty-story tower surrounded by lower structures with landscaped grounds. The Center will not only have adequate facilities for present functions, but provision will be made for continuing growth of the engineering profession.

The Engineering Societies Library will be included, and there will also be

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exhibition space in which the rapid advances in engineering will be interpreted for the general public. An engineering Hall of Fame to perpetuate the contributions of distinguished engineers to modern civilization is also under consideration. In all there will be about 250,000 square feet of floor space.

The industry campaign which Dr. Kelly heads has a goal of \$5,000,000. Members of the various engineering societies are expected to contribute \$3,000,000. This money, together with \$2,000,000 which is available in the assets of United Engineering Trustees, Inc., is expected to meet the \$10,000,000 cost of the new building.

Dr. Kelly also announced that nearly 150 presidents and deans of institutes of technology and engineering schools are supporting the campaign while more than 75 executives—presidents or board chairmen—of major industrial companies throughout the nation are serving as sponsors.

The Founder Societies whose headquarters will be in the new building are: American Society of Civil Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers and American Institute of Chemical Engineers. Eleven Associated societies will also have headquarters in the new building.

In announcing the start of the campaign, Dr. Kelly said, "Engineering Societies are repositories of the fundamental and applied technical knowledge of their fields and are agencies for its dissemination. Their meetings, publications and committee activities crystallize thought on the technical problems of the

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engineering profession and insure that advances in technology become widely known, and available for general application.

"The proposed United Engineering Center is a much needed facility for the Societies. Their operations are seriously handicapped by the inadequate space and obsolescence of their present headquarters at 29 West 39th Street, now more than 50 years old.

"Those of us associated in this campaign believe that the new center is a much needed facility and heartily recommend to industry their financial support of its construction."

Dr. Kelly also pointed out the tremendous growth in the Societies' activities during the past thirty years. The number of chapters throughout the country, for example, has grown from 258 to 684. Student chapters have grown from 220 to 605. Publications have grown from 407 to 1,640.

The Associated societies who will have headquarters in the new building are:

American Institute of Industrial Engineers, Inc.

American Rocket Society, Inc.

American Institute of Consulting Engineers

American Society of Refrigerating Engineers

American Water Works Association
Society of Naval Architects and Marine Engineers

Illuminating Engineering Society
American Society of Heating and Air-Conditioning Engineers, Inc.

The Electrochemical Society, Inc.

American Welding Society

Society of Motion Picture and Television Engineers

Also housed in the building will be Engineering Foundation, Welding Research Council, Engineering Index, Engineers' Council for Professional Development, and American Standards Association.

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Obituaries

The Western Society of Engineers has been informed of the death on September 23 of Frederick I. Wennerholm. Mr. Wennerholm had been associated with the engineering firm of Alvord, Burdick & Howson.

As a member since 1953, his interest in the Western Society has been always evident. Western Society, on behalf of its members, wishes to extend its sincere condolences to his widow.

* * *

The Western Society of Engineers has been notified of the death on October 22 of Bernard A. Schroeder. Mr. Schroeder, a member of Western Society since 1933, had been a partner in the law firm of Schroeder, Hofgren, Brady & Wegner.

The Society, on behalf of its members, wishes to extend its sincerest condolences to his family.

Sandstone Dike Helps Build Skyscraper

A man-made, subterranean solid sandstone dike is part of the foundation excavation for a New York City skyscraper, reported *Construction Methods and Equipment* from New York on Sept. 25.

The dike was created by controlled injections of chemicals from the surface that turned water-bearing sand and gravel into impervious rock.

Ground at the construction site of the 60-story Chase Manhattan Bank was divided into four layers. The top layer was silt and sand, next came a layer of hardpan and boulders, then sand, gravel and boulders, and finally bedrock.

Before the thick foundation walls could be erected on the bedrock, the layer of sand and gravel had to be dried out and tightened. To sink a line of concrete box caissons under air pressure to seal off the wet strata, would have been expensive and time consuming.

Instead, the foundation company alternately injected sodium silicate and calcium chloride solutions through 160 injection pipes into the wet ground.

Reacting with the sand and gravel to form a sort of sandstone, the chemicals solidified a watertight barrier some five-feet thick, extending from bedrock to hardpan.

Nearly 59,000 gallons of sodium silicate were injected. They were augmented by 200 tons of bagged calcium chloride. The work on the dike was completed in 42 days.

Control of Noise Is Part of Comfort

Another new skill is working its way into the air conditioning and ventilating industry. According to Dr. H. C. Hardy, Howard C. Hardy and Associates, who addressed the Illinois Chapter of American Society of Heating and Air-Conditioning Engineers on November 11, "comfort is becoming related to environment, and noise is fast becoming one of the elements people want controlled."

Ventilation and air conditioning contractors will soon be required, said Dr. Hardy, to conduct sound measurement tests on every job before it can be turned over to the purchaser as being completed. To prepare engineers and contractors for conducting sound measurement tests, Dr. Hardy defined noise measurement techniques and the equipment used.

He told about the manner of rating noise and gave examples of the different levels.

In deciding whether a certain sound level is acceptable or if sound reduction procedures are necessary will depend upon the location of the sound. Maximum noise levels that will be tolerated in homes will not be tolerated in commercial offices, according to Dr. Hardy. Also minimum noise levels achieved in homes cannot be achieved economically in business offices, nor are they required. Thus, it would seem that the rating of allowable noise must be based upon experience and customer preference.

Methods of obtaining sound readings for areas appear to be easy with the proper instruments. Once the readings have been obtained they can be converted to sound intensity by the use of a chart based upon sound pressure level. When proper physical data on noise have been measured and computed, the expected subjective reaction can be computed.

There are a number of important factors that affect human acceptance of a noise, such as loudness; the magnitude of background noise; the ease of understanding speech or hearing other desired sounds, such as doorbells, telephones or music (industrial noise was not found to be objectionable when speech could be intelligently conducted at a distance of three feet); the masking effect on undesired sounds, such as office equipment, speech by other conversation groups in which the hearer is not interested, outside traffic noise, etc.; the intermittent transient or repetitive nature of the noise; and the quality, such as whether it is a pure tone or if it has an undesirable connotation.

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Concrete Institute is Scheduled for Feb.

The Annual Convention of the American Concrete Institute will be held Feb. 24-27, 1957, at the Morrison Hotel in Chicago. This 54th meeting of ACI will enjoin many varied discussions on the technical aspects of concrete and concrete construction according to A. Allan Bates, MWSE, vice-president of the Portland Cement Association and general chairman of the Chicago convention committee.



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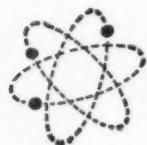
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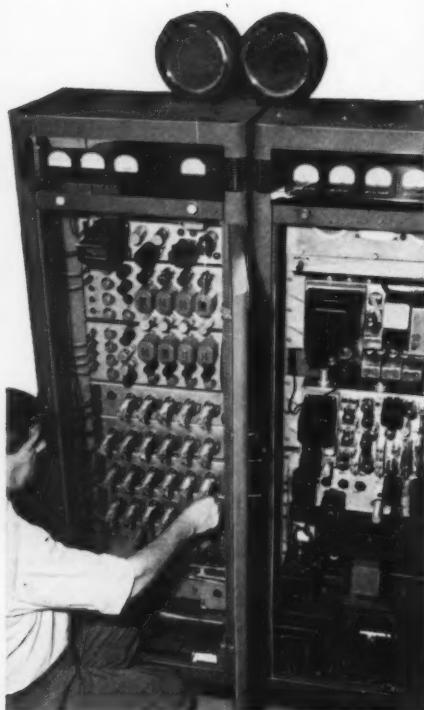
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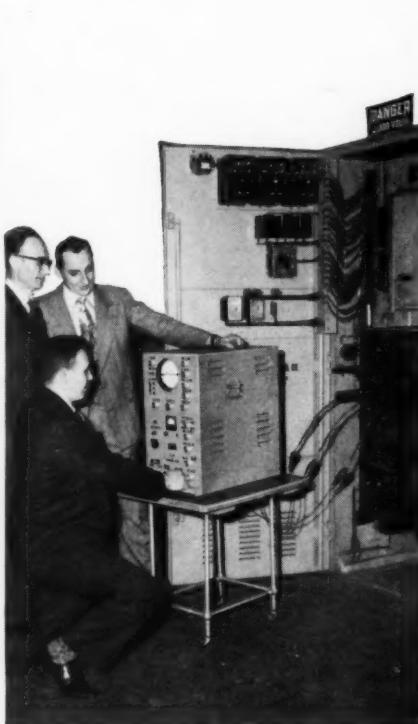


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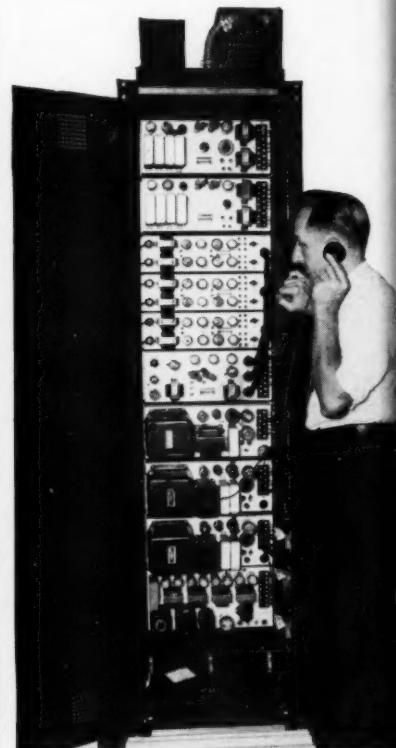
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